

## THE DISAPPEARING MITCHELL DELTA

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**ABSTRACT:** Maps compiled from surveys of 1848-49, air photographs of 1940, and the present (1970) configuration show that the Mitchell River silt jetties, protruding into Lake King, have now been reduced to little more than half the area they had attained 120 years ago, as the result of shoreline erosion following die-back of a former reedswamp fringe. They will disintegrate and disappear completely within the next 50-100 years if erosion continues at the present rate. Factors influencing shoreline erosion include the wave regime, the extent of weed growth (*Zostera* spp.), the presence of driftwood, the effects of grazing stock, and the accumulation of sandy beaches. Shore protection schemes, applied piecemeal, have so far been generally unsuccessful, but in view of the scientific interest and recreational value of the silt jetties, conservation measures (such as the building of rubble walls) are advocated.

### INTRODUCTION

The deltaic silt jetties built by the Mitchell River into Lake King, one of the Gippsland Lakes, are unusual landforms, the origin of which has been the subject of much discussion (Bird 1970). When they were first mapped, in the years 1848-49, they had a cover of scrub vegetation (mainly *Melaleuca ericifolia*) with occasional red gums, and were fringed by marshland with reedswamp (mainly *Phragmites*) spreading out into the bordering lakes. The reedswamp trapped silt and clay brought down by the river during floods in such a way as to build up and extend the delta shoreline; it also served to protect the shoreline from wave attack. The fringe of reedswamp persisted until the early years of the present century, for it was observed by Gregory (1903) during his visit to the Gippsland Lakes in 1901, but by the nineteen-twenties it had largely disappeared.

The loss of the reedswamp fringe has been attributed largely to salinity increase in Lake King following the cutting of an artificial entrance to the Gippsland Lakes in 1889 (Bird 1961, 1962, 1965). Grazing of the reedswamp by cattle when the delta was cleared of scrub and converted to pastureland also contributed to the disappearance of *Phragmites*, but lake salinity is the critical factor because the reeds have also vanished from sectors beyond the reach of cattle grazing, and have failed to reappear on sectors that are no longer grazed. In the absence of the protective

reedswamp fringe, the shorelines of the silt jetties have been attacked by wave action. The Mitchell delta is thus being consumed by erosion: it provides a good illustration of the indirect and unforeseen consequences that may result from man's interference with a natural system (Jennings 1965).

### HISTORICAL EVIDENCE

The pattern and rate of reduction of the silt jetties can be determined with reference to old map and air photographs. The first survey of the southern (Eagle Point Bay) shoreline was made by George Smythe, and is shown on his Coast Survey Plan No. 4. The original map, kept in the Central Plan Office of the Victorian Department of Lands is undated, but is one of a series compiled during the years 1846-51, and probably dates from 1848. The first survey of the northern (Jones Bay) shoreline was made by John Wilkinson in 1849, and is shown on his Gippsland Plan No. 6, also kept in the Central Plan Office of the Department of Lands. The two outlines have been combined in Fig. 1 to show the configuration of the Mitchell delta in 1848-49 as a basis for comparison with the outline shown on air photographs taken in February 1940 and with the present (February 1970) outline.

Caution is necessary when using old maps to determine past landform configuration (Carr 1962). There may have been errors or technical

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limitations in the original survey work or in its cartographic reproduction, and there is the possibility that a map has shrunk, or been stretched, during its storage over a long period. Scales and directions have been checked on the two historical maps and in the original field books, and measurements between identifiable fixed points indicate shrinkage of the order of 3% on Wilkinson's plan. The outlines must therefore be regarded as approximate, but it is possible to make a rough estimate of the extent of the Mitchell silt jetties, downstream from Eagle Point, from the 1848-49 surveys. Such an estimate is based on outlines which include the reedswamp fringe, extending from an inner margin of usually dry land to an outer limit where the lake is up to 5 ft deep. In these terms, the northern silt jetty had an area of 15.11 million sq ft and the southern jetty an area of 13.50 million sq ft in 1848-49.

Further growth of the silt jetties probably took place during the second half of the nineteenth century, but it is difficult to find reliable evidence of this. A parish plan dated 1873 is little more than a rough sketch map, almost certainly inaccurate in showing the southern silt jetty as extending almost half a mile beyond the end of the northern silt jetty, but another parish plan, surveyed in 1893, shows measured widths along boundaries of subdivisions, and is more likely to be accurate in portraying the shoreline. The 1893 outline is in fact very close to that of 1848, the chief difference being that the eastern part of the southern silt jetty appears slightly wider in 1848.

After 1901, as has been indicated, the reedswamp fringe disappeared and shoreline erosion began; by the early nineteen-twenties there was obvious erosion on the delta shoreline (Hart 1922). By 1940, when air photographs were taken by the Royal Australian Air Force, major changes had taken place. A breach known as The Cut (Pl. 2, fig. 1) had formed in the northern silt jetty downstream from Eagle Point Bluff during a 1919 river flood, and a small area of new deltaic terrain had developed outside it, protruding into Jones Bay. With this minor exception, the northern shoreline, relatively simple in outline in 1849, had retreated and become embayed in 1940. This was partly due to the loss of the reedswamp fringe shown on Wilkinson's map. The large embayment immediately W. of Point Lardner was occupied by reedswamp in 1849, and with the disappearance of this the shoreline had retreated by as much as 950 ft by 1940. The extent of recession of the northern shoreline was generally between 50 and 400 ft during 1849-1940, and near the eastern end the northern silt jetty had been breached by shoreline erosion, isolating a small

terminal island. If allowance is made for the readier removal of former reedswamp areas, it is seen that sectors of shoreline facing north-westwards have receded farther than those that faced north-eastwards. This is consistent with the predominance of wave action generated by prevailing westerly winds in Jones Bay. There had also been slight recession along the river banks, but this is too small to be shown on Fig. 1. Overall, by 1940, the area of the northern silt jetty had been reduced to 56.5% of its 1849 extent (Table 1).

TABLE 1  
AREA OF MITCHELL RIVER SILT JETTIES DOWN-  
STREAM FROM EAGLE POINT BLUFF

	(million sq ft)		
	1848-49	1940	1970
Northern jetty	15.11	8.55	6.92
Southern jetty	13.50	10.64	8.65

The Eagle Point Bay shoreline of the southern silt jetty had an embayed configuration in 1848, and in 1940 this was still so, W. of Point Foster, though farther E. the shoreline had become straighter as it receded. At Point Foster, and on sectors farther E., the shoreline had retreated about 200 ft. As the outline in 1893 was essentially similar to that of 1848, most of this recession had taken place within 47 years. Recession was greater on sectors exposed to the predominant S.-W. waves in Eagle Point Bay, especially E. of Point Foster, where the south-westerly fetch lengthens and there is deeper water offshore. Also, the general level of the silt jetties declines eastwards, so that removal of a similar volume of material produces greater shoreline recession in the eastern half. Overall, by 1940, the area of the southern silt jetty had been reduced to 79.3% of its 1848 extent. The greater percentage reduction on the northern silt jetty, compared with the southern, is due partly to the formation of The Cut, but mainly to the fact that the reedswamp fringe which had died away was generally broader on the northern than the southern shoreline.

The third outline shown on Fig. 1 is based on measurements made in February 1970, correcting earlier surveys, including one based on air photographs taken in March 1966. It shows that the earlier trends have continued over the past thirty years. On the Jones Bay shoreline there has been further recession of up to 150 ft, and two new breaches have been formed near the eastern end of the northern silt jetty on sectors that were very narrow in 1940. Another breach appears imminent south of Point Lardner, where the minimum width of the northern silt jetty is now only 48 ft (Plate 2, fig. 2). The Eagle Point Bay shoreline has receded up to 250 ft, and the breach

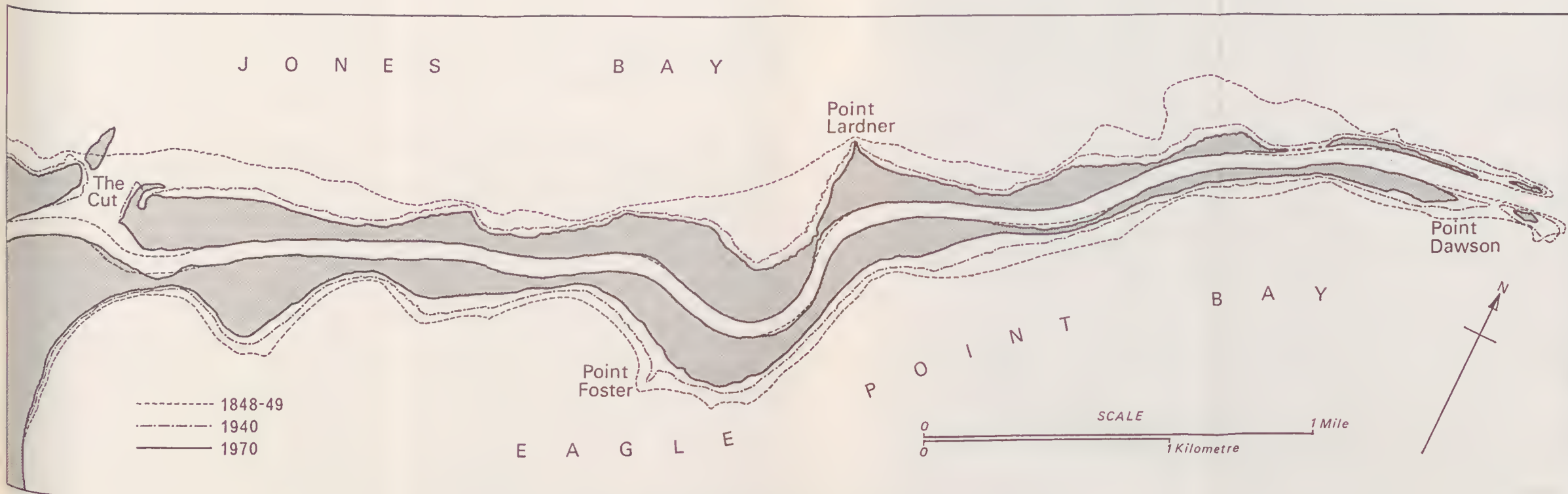


FIG. 1—The past and present configuration of the Mitchell River silt jetties.

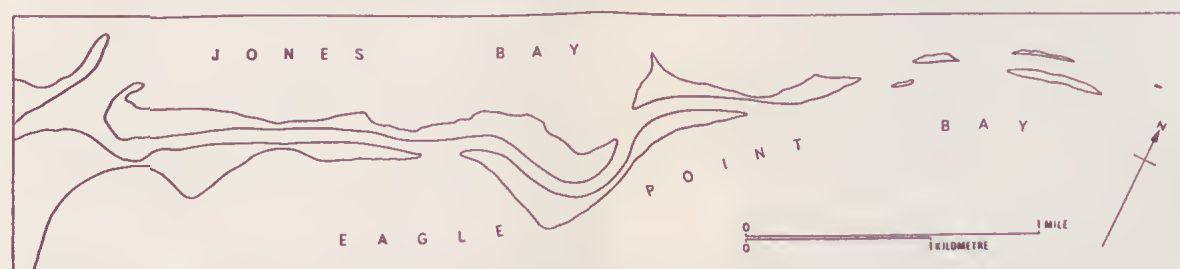


FIG. 2—Configuration of the Mitchell River silt jetties in the year 2000 if erosion continues at its present rate.

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near the eastern end of the southern silt jetty is now much broader than it was in 1940. A section of the southern silt jetty a mile downstream from Point Foster was only 60 ft wide in 1940, and would probably have been breached by now but for the construction of protective shoreline works by the Ports and Harbors Branch of the Public Works Department in 1962, when the width had been reduced to 28 ft (Pl. 2, fig. 3 and Pl. 3, fig. 1). There has been further growth of the deltaic area at The Cut, extending into Jones Bay, but during the past thirty years when erosion has been predominant, the area of the northern silt jetty has been reduced by 19.1% and that of the southern silt jetty by 18.7%.

The second set of figures (1940-70) may be used as a basis for prediction. If this rate of areal reduction is maintained, the northern silt jetty will be completely removed within 128 years and the southern within 130 years. Alternatively, if the lake shorelines retreat as much in the next thirty years as they have since 1940, considerable disintegration will have taken place by the year 2000 (Fig. 2). The northern silt jetty will have at least two new breaches, one W. of Point Lardner, the other farther E., and the southern silt jetty will have been breached just W. of Point Foster, and will have a broad gap farther E., leaving the fishing village at Point Dawson on a shrunken islet. As the formation and broadening of such breaches increases exposure to wave action (enabling waves from Eagle Point Bay to attack the northern bank of the river for instance) the rate of reduction is likely to accelerate, and the life span of the remaining silt jetties will be correspondingly shortened. Taking this into account, it is estimated that, if present conditions persist and if successful shoreline protection schemes are not introduced, the Mitchell River silt jetties downstream from Eagle Point Bluff will disappear within the next 50-100 years.

## PROCESSES OF SHORELINE EROSION

Recession of the lake shoreline of the Mitchell delta is due primarily to wave action. When the silt jetties had a protective fringe of reedswamp, wave action was impeded and the shoreline advanced by sedimentation in the sheltered reedswamp environment. There is now very little *Phragmites* on the Mitchell delta, even on the new deltaic area outside The Cut (Pl. 2, fig. 1). It grows sporadically along the river banks, and there are small clones near the eastern end of the silt jetties, but these are no longer spreading into the lake; in general they are growing up on the delta, behind the eroding shoreline. Once the reedswamp fringe had been lost, waves began to

attack the unprotected shoreline, and now there are receding cliffs of silty alluvium, often with salt marsh vegetation on the margins splashed by brackish lake water. The silt jetties slope away from the river banks to the lake shore, so that generally the height of these bordering cliffs increases as they are cut back. In embayments on the southern shoreline W. of Point Foster they are up to 4 ft high (Pl. 3, fig. 2). On sectors of the northern shoreline where *Melaleuca ericifolia* scrub is no longer protected by a reedswamp fringe, large slabs of root-bound material undercut by wave action calve off and fall into the lake (Pl. 3, fig. 3).

The vigour of wave attack is related to the lengths of fetch and to the direction and strength of winds blowing over the adjacent lake. When the prevailing westerly winds are blowing, water level in the eastern part of the Gippsland Lakes may rise more than 1 ft above calm weather level, whereas easterly winds lower the level of Lake King, exposing abrasion ramps cut in silty alluvium in front of the receding cliffs of the deltaic shoreline. Westerly winds therefore produce larger and more effective waves breaking on the deltaic shoreline, and this is when most of the erosion takes place. Local residents report that parts of the southern shoreline were cut back 4 to 6 ft in a few hours during a westerly gale in 1968. By contrast, strong easterly winds blowing over a lowered lake surface produce little shoreline erosion. The level of Lake King may also be raised by high river discharge (it rose more than 5 ft during the 1952 floods) and under these conditions wave attack can be vigorous, and considerable scour takes place as the result of current action in the river channel. Waves produced by motor boats have also contributed to undercutting and erosion of the channel bank (Pl. 4, fig. 1).

Another factor influencing the vigour of wave attack is the extent of water weed (chiefly *Zostera* spp.) in Lake King. This has fluctuated over recent decades. During the nineteen-fifties, weed growth was sparse but in 1961 *Zostera* began to spread, and it has since remained extensive in water up to 6 ft deep. Earlier fluctuations of weed growth have been reported: Bury (1954) recalled that in 1920 weed growth, which has been prolific, disappeared from Lake King. The reasons for these fluctuations are not known. It is possible that *Zostera* grows better when the lake becomes relatively saline after a series of dry years, and that freshening of the lake by river flooding (which last occurred on a large scale in 1952) is unfavourable for its growth. Infestations of the crab *Paragrapsus gaimardii* are apparently correlated with depletion of *Zostera*, but it is not yet clear